EIFS Potential Contributions to LEED® Projects
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“Treat the Earth well. It was not given to you by your parents. It was loaned to you by your children”

-Kenyan Proverb
The LEED Design and Certification Process

The Leadership in Energy and Environmental Design (LEED) for New Construction and Major Renovation rating system, created by the United States Green Building Council (USGBC), provides a set of performance standards for certifying the design and construction phases of commercial, institutional and high-rise residential buildings. It is a comprehensive rating system that deals with many criteria that are beyond the scope of an exterior wall system. BASF Wall Systems has prepared this brochure as an introduction to the potential contributions our Exterior Insulation and Finish Systems (EIFS) can make towards LEED certification. More information on all LEED programs can be found at www.usgbc.org

Design and Construction Processes
Perhaps the greatest challenge facing the green construction movement is the creation of buildings that provide improved environmental performance at a competitive initial cost. This can be addressed through the Integrated Design process. Integrated Design projects start with a series of charrettes, which are meetings that include architects, building owners, MEP engineers, code/regulatory officials, contractors and other stakeholders. By considering how building systems interact with each other early in the design process, architects are able to create designs that meet functional, environmental and cost objectives.

Once a project has been registered with USGBC, the design team can submit preconstruction data to USGBC for preliminary rulings. No LEED points are awarded at this time. USGBC evaluates this data and issues “Credit Anticipated” or “Credit Denied” rulings that help guide the design team. After the building is complete, construction and building performance data are submitted to the USGBC, who evaluate the project and awards points. If all LEED prerequisites have been met, a Certified, Silver, Gold or Platinum rating is assigned, based on the total number of points awarded.
Attainment of environmental goals in addition to functional, aesthetic and economic objectives adds a new level of challenge to the architectural design profession. The Integrated Design process provides architects with greater resources by bringing together participants with diverse interests and expertise. Within the Integrated Design process, knowledgeable material selection that contributes toward multiple design objectives is one key factor that influences the degree of success a project will achieve.

**LEED Points**
The LEED certification system is based on six major categories. Each of the categories has certain minimum requirements (prerequisites), which have to be met, before LEED points can be earned.

- Sustainable Sites (SS)
- Water Efficiency (WE)
- Energy and Atmosphere (EA)
- Materials and Resources (MR)
- Indoor Environmental Quality (IEQ)
- Innovation in Design (ID)

**Building Product Selection**
Reflecting the fact that every building is unique, LEED points are awarded for buildings that meet specified design and performance criteria. The total design and overall building performance are evaluated, not just the individual parts. Specific products contribute to LEED ratings in two ways. First, material composition can contribute to an overall score. For example, the recycled material content of a product becomes part of a total recycled material score that may qualify for a LEED point. Second, building products can facilitate attainment of building performance objectives. For instance, a product that adds insulation value contributes to the overall thermal performance of the building envelope, and therefore to attainment of energy consumption objectives.
LEED category: Energy and Atmosphere

Optimize Energy Performance
As a key component of the building envelope, the most important area where BASF EIFS can contribute to LEED projects is attainment of Energy Performance objectives. Energy and Atmosphere (EA) Credit 1 provides up to 19 points for buildings that demonstrate improvements in energy consumption compared with a baseline case*. Further, as of April 27, 2009, all LEED-rated new construction projects must demonstrate energy consumption at least 10% lower than the baseline case.

Regardless of the level of energy reduction targeted, creating a tight, highly insulating building envelope is essential. Efficient building envelopes add relatively little cost to a project, and that premium is quickly returned through lower heating/cooling costs. In addition, efficient building envelopes can permit downsizing of HVAC systems. Such downsizing can more than compensate for higher building envelope costs, resulting in lower initial cost, reduced energy consumption and lower operating costs.

There are two ways to demonstrate improved energy efficiency: Whole Building Energy Simulation and prescriptive compliance path.

Whole Building Energy Simulation:
To earn up to 19 points under EA Credit 1, a Whole Building Energy Simulation is required. This involves using thermal modeling software to compare the energy performance of a baseline building design with the actual design.

Many thermal modeling software systems are available; however, the US Department of Energy’s eQuest program fully meets LEED requirements, and can be downloaded free at http://doe2.com/equest.

Prescriptive compliance path:
For projects where the complexity of thermal modeling is not warranted, Prescriptive Compliance Options are available. The prescriptive design defined by the ASHRAE Advanced Energy Design Guide for Small Office Buildings can be used for office buildings that are less than 2,000 square meter. Compliance with all requirements of the guide will provide 1 point under EA Credit 1.

Similarly, for retail buildings with less than 2,000 square meter, the prescriptive design defined by the ASHRAE Advanced Energy Design Guide for Small Retail Buildings will become an option once LEED for Retail New Construction has been formally launched.

ASHRAE Advanced Energy Guide for Small Warehouses and Self Storage Buildings 2008 provides guidance for designing warehouses and self storage buildings with less than 5,000 square meter.

All three ASHRAE documents can be downloaded free at www.ashrae.org/publications/page/1604.

Buildings up to 10,000 square meter (excluding health care, warehouse or laboratory projects) can use the Advanced Buildings Core Performance Guide created by the New Buildings Institute to attain 1-3 points. Information on the Core Performance Guide can be found at: www.advancedbuildings.net.

* Baseline case must comply with the minimum requirements defined by ANSI/ASHRAE/IESNA Standard 90.1-2007
LEED Buildings Need Air Barriers

Wall cladding design is directly impacted by two aspects of these performance validation methods – air barrier and insulation requirements. All of the Prescriptive Design Guides require the use of air barriers, while energy modeling software incorporates the beneficial effect of air barriers into their thermal performance calculations.

Water drainage EIFS offered by BASF under the Senergy incorporate fluid-applied air barrier materials that are designed to function as part of an overall air barrier system. These air barrier materials facilitate use of adhesively fastened EIFS, eliminating the need to puncture the air barrier with cladding fasteners. They also act as water-resistant barriers that protect sheathing from incidental moisture intrusion. Senergy trowel or spray- and roller-applied air barrier materials* are suitable for use behind all cladding materials, allowing the air barrier to be fully installed and inspected before claddings are applied, even on buildings that feature mixed cladding systems.

Thermal Insulation is a Key Consideration

The second aspect of EA Credit 1 that impacts wall claddings relates to insulation of the building envelope. Thermal modeling programs use R-values (thermal resistance) and U-factors (thermal transmittance) for various materials and wall assemblies, respectively, which are listed in ASHRAE 90.1-2007 Appendix A. The ASHRAE standard takes into account thermal bridging, where heat is conducted through the wall by concrete, blocks and studs, particularly those made of metal. Thermal bridging can reduce the effectiveness of cavity insulation by up to 55%, whereas the continuous exterior insulation in BASF EIFS yields its full R-value.

* Senershield and Senershield-R

While projects that use thermal modeling software to quantify energy consumption have no specific insulation requirements, they benefit from continuous exterior insulation. The high insulation value of BASF EIFS is captured by thermal models, while the low cost of adding insulation in this way improves project economics.
Prescriptive compliance methods offer the option of defined exterior wall insulation schedules based on wall configuration and climate zone (Figure 1). For steel and wood framed structures, these schedules call for use of continuous exterior insulation to address thermal bridging, plus additional cavity insulation. While these systems provide the needed insulation value, they are not suitable for all applications. The blend of exterior and cavity insulation can create an inappropriate dew point location within the wall cavity. Economic factors may also come into play. Architects can select alternative insulation methods as long as they meet maximum U-factor requirements. When BASF EIFS is used, the optimum solution in most cases is reached by selecting an expanded polystyrene (EPS) insulation thickness that provides the required U-factor.

Figure 2 shows the maximum U-factors required by ASHRAE Guides as well as by the Advanced Buildings Core Performance Guide. Since the two prescriptive guides and the ASHRAE 90.1-2007 standard contain slightly different requirements, this table lists the most stringent ASHRAE value for climate zone 1. Figure 2 also shows the minimum EPS insulation thickness required in BASF EIFS to meet these requirements.

In summary 90 mm of continuous exterior EPS insulation in BASF EIFS systems meets or exceeds all insulation requirements for all prescriptive guides. Placing all of the insulation outside the wall cavity also reliably moves the dew point outside the sheathing in all climate zones, beyond the air and water-resistant barrier. This minimizes the risk of condensation within the wall cavity.

Figure 2: Wall (above grade) insulation requirement for climate zone 1 according to ASHRAE: Advanced Energy Design Guide Requirements and New Building Institute: Core Performance Guide Requirements

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Figure 1: International climate zone definition

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Note: The U-factors above represent the most stringent ASHRAE requirements. U-factor conversions to EPS thicknesses are based on values listed in ASHRAE 90.1-2007 Appendix A Tables A3.1D, A3.3 and A3.4. All thicknesses have been rounded up to the nearest 10 mm, and meet or exceed prescriptive requirements.
LEED category: Materials and Resources

Building Reuse
Materials and Resources Credit 1.1 provide a maximum of 3 LEED points for maintaining 95% of existing walls, floors and roofs. The light weight and ease of installation of BASF EIFS make them an ideal choice for recladding existing buildings, helping to refresh and renew existing structures. In doing so, BASF EIFS lower the U-factor of the building envelope, also contributing to EA Credit 1 as described above. Since the energy use reduction required by LEED is less stringent for major renovations compared with new construction, the contribution made by BASF EIFS can be substantial.

Construction Waste Management
Materials and Resources Credit 2 offer 1 point for diverting 50% and 2 points for diverting 75% of construction waste from disposal in landfills or incineration. BASF EIFS produce very little waste and all BASF packaging materials – pails, paper and plastic bags and cardboard – are recyclable. EPS insulation scraps are also recyclable.

Recycled Content
Materials and Resources Credit 4 provide 1 point for incorporating 10% and 2 points for incorporating 20% post and pre-consumer recycled materials. To earn this credit, designers teams are advised to keep records documenting the recycle content of heavy materials used in large quantities. Structural steel, concrete, synthetic gypsum board and copper are good examples. Although research targeting incorporation of recycled materials into BASF EIFS products is ongoing, the light weight of BASF EIFS limits the significance of its contribution to this LEED credit.

Regional Materials
Materials and Resources Credit 5 offer 1 point for projects that use 10% of materials “extracted, harvested or recovered, as well as manufactured, within 500 miles of the job site”. An additional point is granted for using 20% of regional material. BASF operates a manufacturing facility in the UAE, using materials extracted from a number of sites. Depending on the location of the project and the products used, BASF wall cladding products may contribute toward these points.

Before
Outdated, unwelcoming and lacking continuity, these stores were excellent candidates for renovation with BASF EIFS.

After
BASF EIFS tied the shops together with detailing and harmonious colours and added insulation value.
LEED category: Indoor Environmental Quality

Thermal Comfort
Indoor Environmental Quality Credit 7.1 offers a point for thermal comfort. The building envelope must meet the requirements of ASHRAE Standard 55-2004 Thermal Comfort Conditions for Human Occupancy. The carefully integrated design of both building envelope and HVAC systems described under EA Credit 1 above clearly contributes to attainment of IEQ Credit 7.1.
Conclusions

The benefits of BASF EIFS in LEED projects are derived from their ability to create an exterior appearance that meets the architect’s aesthetic objectives while providing high insulation value and an integral air barrier, at a very attractive cost.

By incorporating BASF EIFS in the early stages of a project, design teams can advance multiple project objectives simultaneously (Figure 3). Doing so BASF EIFS contributes to overall project success in addition to realization of a targeted LEED rating.

With an extensive range of colours, textures and finishes to choose from sustainable design has never been so attractive.

Figure 3: Senergy EIFS potential contribution to LEED 2009 for New Construction & Major Renovations.

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<td>Credit 4.1 &amp; 4.2: Recycled Content</td>
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Note: To achieve LEED certification level 40 points have to be awarded.
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